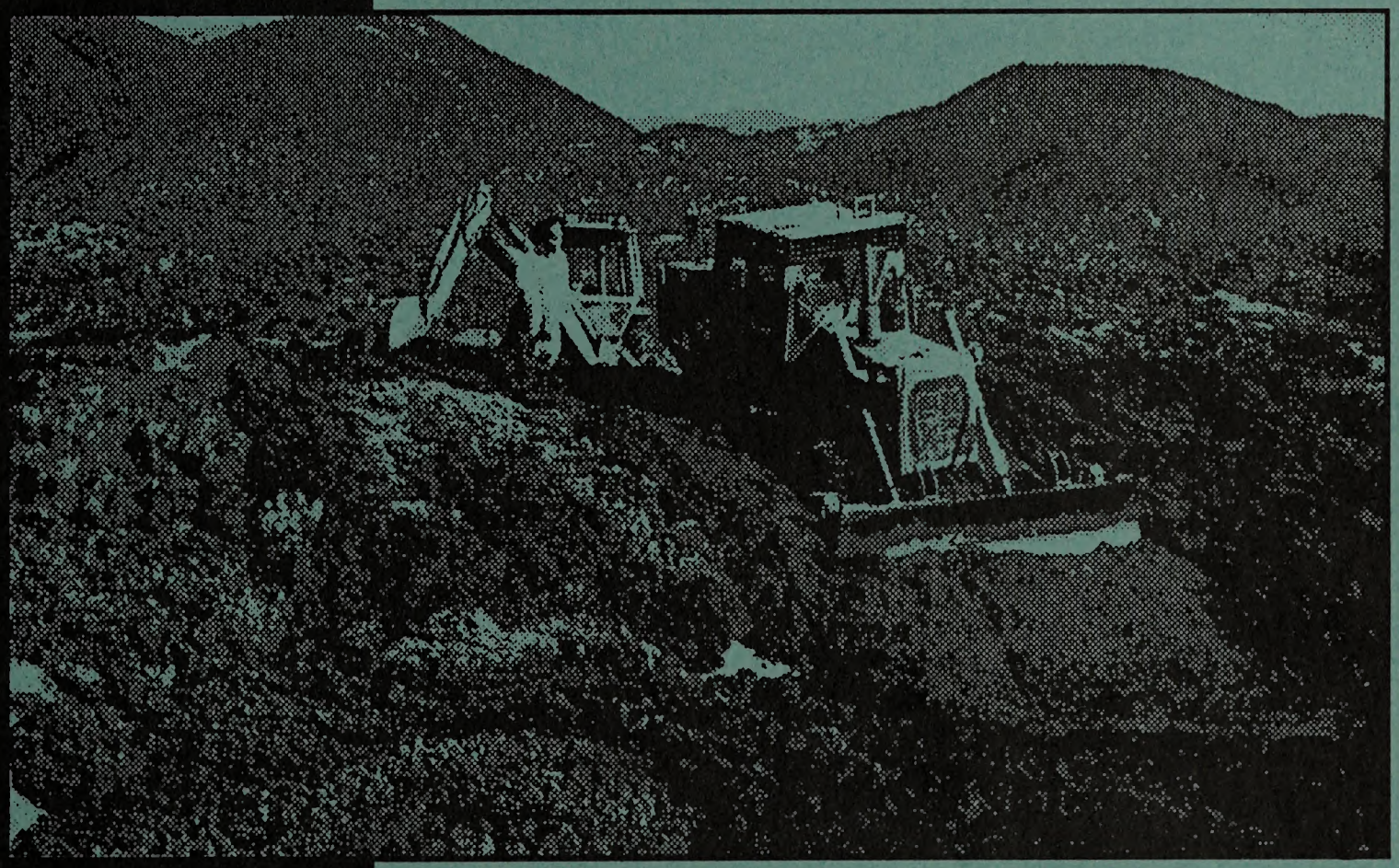
Reclamation of the Timberline Heap Leach

Toole County, Utah



chnical Note 386

Reclamation of the Timberline Heap Leach

Tooele County, Utah

Steven J. Brooks

BLM/SC/PT-92/002+3042

Introduction

The purpose of this tech note is to disseminate information concerning cyanide neutralization methodologies and limitations when it is not feasible to accomplish cyanide neutralization by circulating water through a heap leach. This paper focuses on reclamation of the Timberline heap leach.

In June 1984, Azeredo Minerals, subsequently renamed Timberline Industries, submitted a proposal for a custom heap leach using cyanide to recover precious metals. The facility was built near the mouth of Ophir Canyon along the western flank of the Oquirrh Mountains in Tooele County, Utah. The company proposal was to leach 20,000 tons annually for a minimum of 10 years. Ore was to be obtained from the dumps of the Tintic, Ophir, and Mercur Mining Districts located in the area. The heap leach operated for less than 2 years and was subsequently abandoned.

Millsite Facilities

The proposed cyanide heap leach facility consisted of a 230-by-150-foot pad, pregnant and barren solution ponds, and a Merrill-Crowe zinc precipitation plant. The metal precipitate was smelted on site. A solution containing about 5 pounds of sodium cyanide per ton of water, buffered to pH 11 with lime, was applied by a sprinkler system to the top of the ore stacked on the leach pad. Ore hauled from the Jumbo Mine in the Tintic Mining District was placed on a heap leach pad lined with a single layer of 40-mil PVC over compacted native soil. Coarse-grained ore was placed on the pad first, with finer-grained material on the top, to a total thickness of 6 feet.

A water well was drilled on-site to provide process water. The standing water level is about 300 feet deep. Monitoring wells were originally required along the perimeter of the leach pad, along with a seepage detection ditch and sump.

In addition to the notice submitted to BLM, the heap leach was also permitted through the Utah Division of Oil, Gas, and Mining; Utah Division of Environmental Health; Bureau of Water Pollution Control; and Tooele County Health Department. Tooele County required a $20,000 bond. After review of the BLM reclamation plan, Tooele County authorized BLM to make obligations against the bond.

Site closure was to include neutralization of the leach pile with calcium hypochlorite or hydrogen peroxide, facility removal, grading, and revegetation.

Operational difficulties and a lack of adequate funding resulted in an as-built facility which varied considerably from the proposed and/or permit-stipulated design. Monitoring wells were not placed along the perimeter of the leach pad, and a seepage detection ditch and sump were not constructed. Only one solution pond was constructed, along with a small reagent mixing tank for adding make-up solution. About 4,700 tons of ore having low permeability were placed on the pad. The low permeability resulted in a conversion to a flood leach, which simply consisted of berming the ore to pond the leach solutions (Figure 1).

The heap leach operated intermittently from 1984 to 1986. On April 13, 1989, representatives of Timberline stated that the company was bankrupt and relinquished their bond to Tooele County for use in reclaiming the site.

Figure 1. Berms were constructed for conversion to flood leach. Auger samples are being collected. The light color of the heap is from lime added for pH control.

Preassessment Remedial Actions

Initial efforts to obtain reclamation of Timberline consisted of a series of letters from the regulatory agencies noting a lack of reclamation and other deficiencies, such as holes in the pond liner (Figure 2); improperly stored and leaking cyanide drums (Figure 3); and deer, raptor, and rodent fatalities on-site. The animal fatalities were reported in a local paper, the *Tooele Transcript*. The operator was not responsive to these letters.

Initial emergency responses were conducted by the Tooele County Sheriff's Department, which removed the cyanide drums with the assistance of Barrick Mercur Mines in April 1989. Barrick placed 800 pounds of calcium hypochlorite in the solution pond to neutralize the cyanide, eliminating the immediate hazard. The liquid in the pond was removed by U.S. Pollution Control, Inc., and taken to their hazardous waste disposal facility.

It was anticipated that a significant precipitation event would flush more cyanide from the leach pile into the solution pond. This occurred in September 1989, when about 0.5 inch of rain fell. Free cyanide levels went from 0 to 35 mg/l in the solution pond, despite the large amount of hypochlorite placed in the pond earlier. Pond samples (Figure 4) confirmed the presence of significant amounts of cyanide in the leach pile and the fact that reclamation would need to include steps to neutralize the cyanide.

In order to assess the cyanide content of the leached ore, six composite samples were collected by augering through the leach pile (Figure 1). Total cyanide ranged from 2.7 to 28.4 mg/kg. In light of the amount of cyanide that had accumulated in the solution pond, these cyanide concentrations are surprisingly low and are not considered to be representative of cyanide levels. The low cyanide levels reported may have been due to the 6 weeks that transpired between sample collection and analysis. Subsequent samples analyzed the day after collection had weak acid dissociable (WAD) cyanide concentrations of about 140 mg/kg.

Figure 2. *Numerous rips in the liner are visible.*

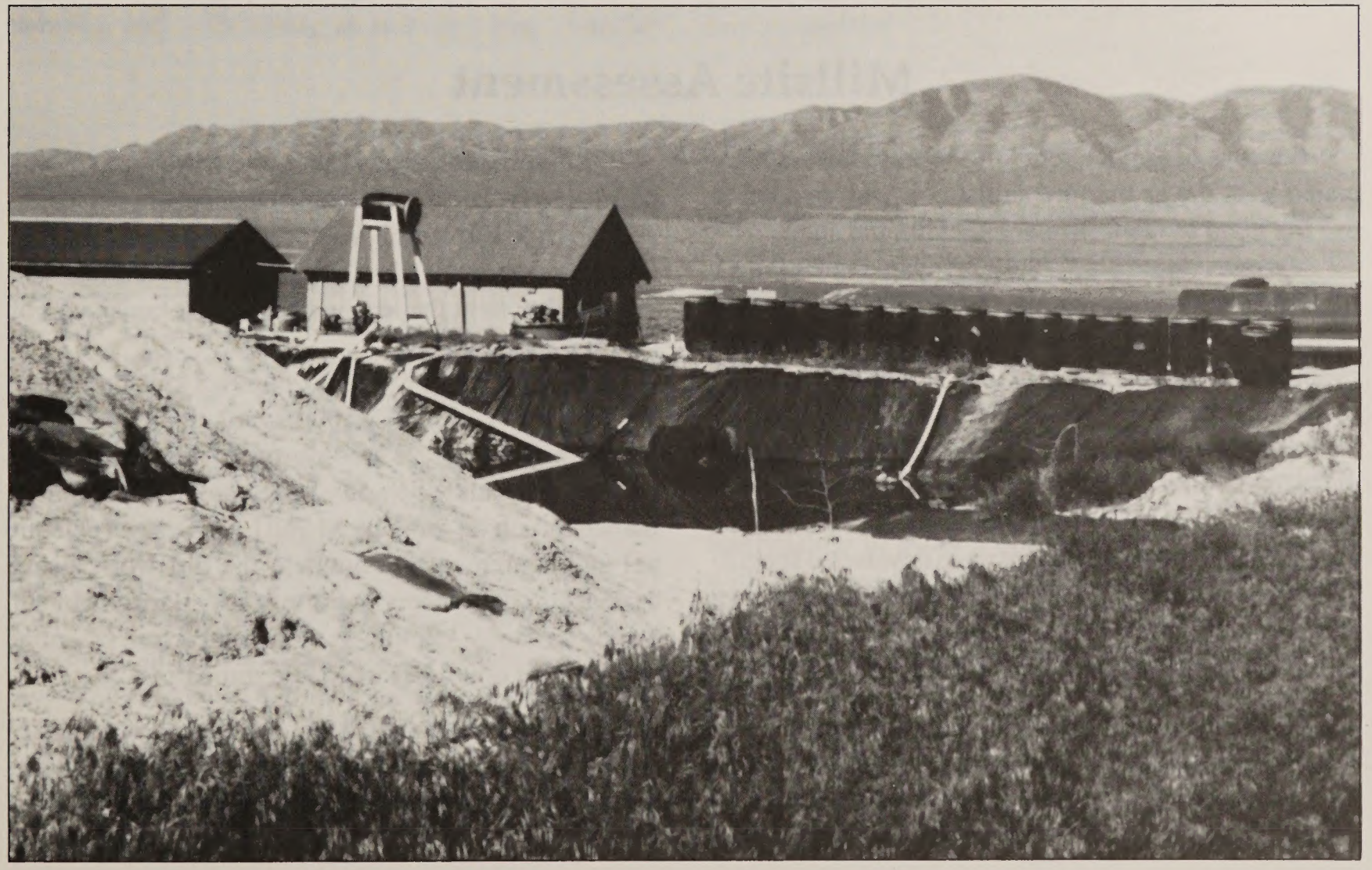


Figure 3. *Improperly stored cyanide and other reagent containers.*

Figure 4. *A representative from Barrick Mercur Mines is sampling the solution pond after hypochlorite has been added to neutralize the cyanide.*

Millsite Assessment

Because of the inherent long-term problems associated with the abandoned millsite, it was decided to use the bond to neutralize and reclaim the site.

Various options for obtaining cyanide neutralization and reclamation within the $20,000 bond were considered. The major objectives were to (1) reduce cyanide to nontoxic levels before winter precipitation flushed more cyanide from the leach pile and (2) meet state regulatory standards of 1 mg/kg WAD (weak acid dissociable) and 2 mg/kg total cyanide prior to abandonment. The cyanide concentration standards to be attained prior to abandonment were developed specifically for the Timberline millsite due to circumstances that precluded sampling effluent from the leach pile and to the higher cyanide levels expected in the ore.

A conceptual procedure for neutralization was developed by BLM, the Tooele Department of Health, and the Utah Bureau of Water Pollution Control. This procedure acknowledged the major limitations and proposed to treat the leached ore in lifts consisting of layers 1 foot thick.

Estimates of the cost to contract out the entire project exceeded the $20,000 available, so other options were sought. The only option developed that reduced costs and allowed work to proceed in a timely manner involved using BLM Salt Lake District personnel and equipment to complete the dirt work, using experienced volunteers from the nearby Barrick Mercur Mines to handle chemicals, and contracting essential services not otherwise available through BLM.

Cyanide Neutralization Procedures

The major limitations in cyanide neutralization methodology were the low permeability of the heap leach and the dilapidated condition of the sprinkler system and liner, which prohibited neutralization by circulating a solution through the leach pile. Treatment of the ore in lifts was considered to be feasible; however, additional expertise was necessary to provide project analysis, address BLM safety concerns, develop detailed chemical analyses, and prepare a comprehensive neutralization plan.

JBR Consulting Group was contracted to prepare neutralization and safety plans and provide onsite supervision. JBR suggested the use of hydrogen peroxide to neutralize the cyanide. Hydrogen peroxide has the advantage of being relatively safe and had been shown to be effective when used under somewhat similar circumstances at the Annie Creek Mine (McGrew and Thrall, 1987).

Bench tests were conducted on fresh heap leach samples mixed to saturation using a 100 ppm solution of hydrogen peroxide, buffered to pH 11 with sodium hydroxide, and 5 ppm copper sulfate. The tests demonstrated that cyanide could be reduced to below Utah Bureau of Water Pollution Control standards.

Safety Plan

Concern for safety was paramount. Field operations could not begin until it had been demonstrated to BLM management that operations would be conducted with minimal risk.

JBR prepared a safety plan (Appendix 1) that provided for protection one level greater than expected to be needed onsite. The safety plan included providing onsite training, collecting sensidyne tube cyanide samples, and maintaining an activities log. Anyone working on the leached ore pile was required to wear a Monitox free cyanide detector with digital readout and beeper set at 10 ppm. No free cyanide was detected during operations.

All on-site personnel were required to wear Tyvex suits, along with rubber boots and gloves. Reagents were mixed by trained personnel from Barrick Mercur Mines, who were required to wear splash and respiratory protection.

Millsite Reclamation

Condemnation under BLM Manual Section 9232-1 was completed to allow removal of the large amount of junk on the millsite. Reclamation began on October 16, 1989. Salt Lake District's Operations Division provided a D-6 dozer, 3,000-gallon pumper, 600-gallon pumper, flatbed dump truck, and backhoe, along with operators. Barrick provided their 900-gallon hydromulcher and two men who mixed and applied the neutralizing solution.

The ore neutralization procedure consisted of mixing 100 pounds of hydrogen peroxide and 5 pounds of copper sulfate with 900 gallons of water in the hydromulcher and then buffering the solution to pH 11 with sodium hydroxide. The solution was sprayed on the leached ore and diluted with approximately 11,000 gallons of water from the tankers (Figure 5), resulting in a solution of about 500 ppm hydrogen peroxide on the leach pile. About 1 foot of leached ore was mixed to saturation by the bulldozer and pushed into the solution pond (Figure 6).

All piping and other debris were treated with the neutralizing solution, allowed to sit overnight, and then taken to the Tooele County dump.

The neutralization process was completed in 6 days by eight workers. It was quite time-consuming due to the large amounts of water needed and the inefficiency in using a bulldozer to push treated ore with the consistency of saturated mud off the pad (Figure 7). The bulldozer got stuck twice, and there were frequent delays while waiting for additional water to arrive.

Reclamation included contouring the leach pile to a low mound and hydromulching the disturbed area with a grass and forb seed mixture (Figure 8).

Figure 5. *The trailer-mounted hydromulcher behind the pickup was used to apply reagents, with the additional water needed to reach the desired concentration being sprayed on by the BLM fire pumpers. Note the protective clothing being worn*

Figure 6. *A dozer was used to mix the ore and reagents.*

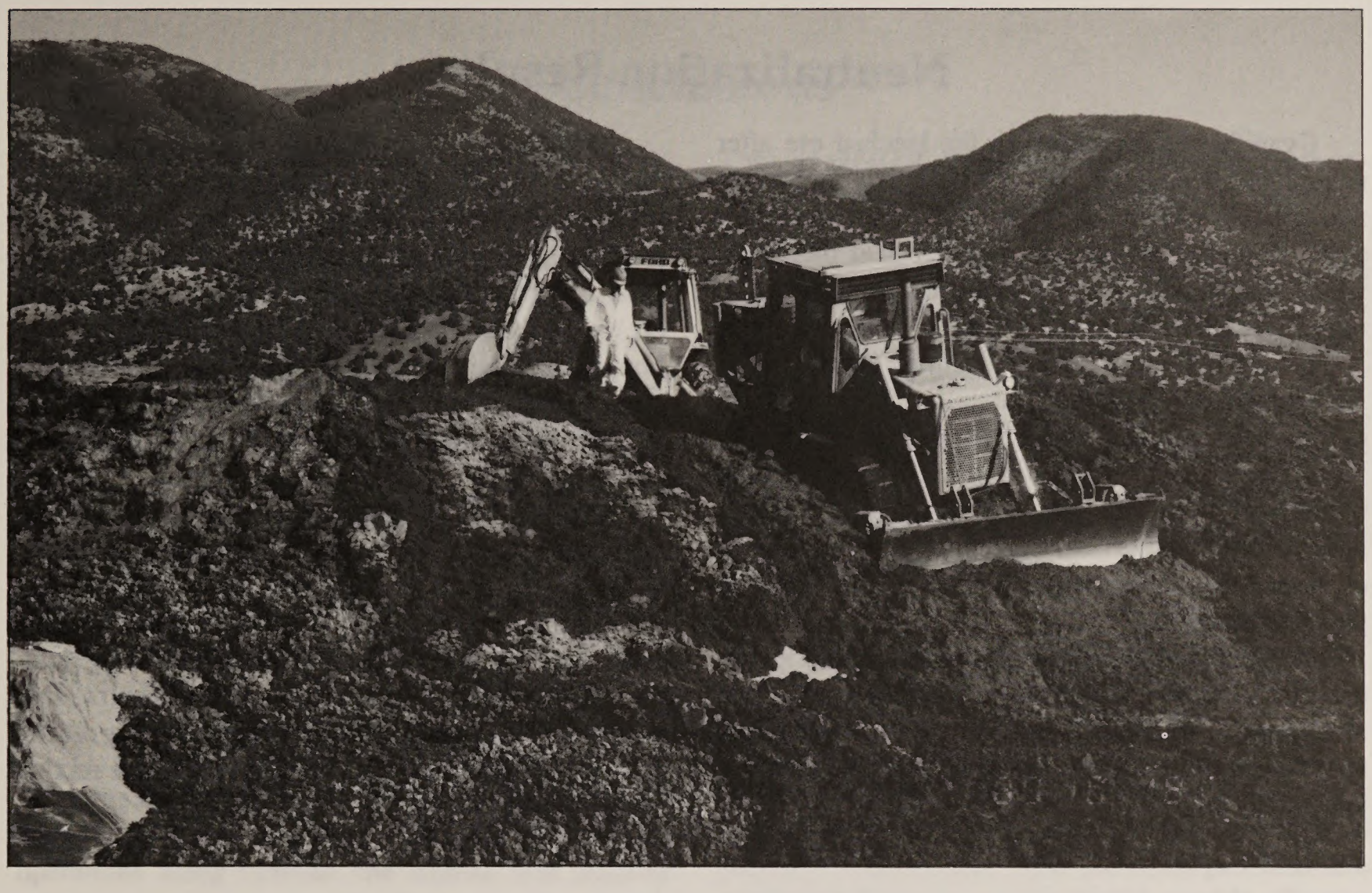


Figure 7. *After mixing the ore to saturation, the material was pushed into the solution pond.*

Figure 8. *Cleaned up and recontoured millisite.*

Neutralization Results

Cyanide concentrations in the leached ore after neutralization averaged 6.3 mg/kg WAD and 24.03 mg/kg total cyanide. High total cyanide as compared to WAD cyanide indicates metallurgical problems, which would result in high cyanide consumption in an active heap leach due to cyanide forming stable nontoxic complexes (personal communication, Buck, 1989). The leached ore currently contains nontoxic amounts of cyanide and the immediate hazards have been eliminated; however, state standards were not met after the initial treatment. The site was sampled on a yearly basis with the expectation that further reductions in cyanide concentrations would result in attainment of permitted amounts.

McGrew and Thrall (1987) report that H_2O_2 was used at the Annie Creek Mine to neutralize cyanide in a heap leach. About 0.001 gallon of H_2O_2 was used per ton of spent ore, with the ore and solution being mixed to saturation.

At the Annie Creek Mine the H_2O_2 was circulated through the heap in the same sprinkler system used for leaching. The ore is highly permeable. A total of 2.4 pore volumes of neutralizing solution and 4 pore volumes of fresh water were circulated through the spent ore over a 97-day period. At the end of the neutralization cycle at the Annie Creek Mine, effluent from the heap measured 0.57 ppm total cyanide and 0.09 ppm WAD cyanide. Cyanide concentrations in the ore were not reported.

At the Timberline millsite, 0.01 gallon H_2O_2 was used per ton of ore. It was hoped that additional H_2O_2 would compensate for the lack of circulation and mixing. Failure to meet State standards is attributed to comparatively poor mixing of the neutralizing solution. Optimally, only 1 pore volume of neutralizing solution was applied to the ore, which probably did not mix completely due to the inefficiency of the mixing method.

Monitoring

Annual sampling of the Timberline Heap was done until cyanide levels met the Utah Division of Water Quality standards of 1 mg/kg WAD and 2 mg/kg total cyanide. The heap was sampled on March 21, 1990, and on April 9, 1991. Four composite samples were collected each time by augering to a depth of 3 feet (or until the liner was encountered) along the centerline of the heap. In 1990, WAD cyanide levels averaged 12.48 mg/kg and ranged from 2.12 to 32.68 mg/kg. Total cyanide averaged 27.6 mg/kg and ranged from 11.12 to 49.03 mg/kg. The highest cyanide concentration occurred in the backfilled solution pond, which also contains the greatest thickness of ore.

After receiving the 1990 sample results, the Division of Water Quality altered their sampling parameters to require measurement of rinsate cyanide concentrations but did not change the neutralization standards of 1 mg/l WAD and 2 mg/l total cyanide. After researching cyanide rinsate testing procedures, the Bureau proposed using the meteoric water mobility procedure. This procedure was approved by the Division of Water Quality. Briefly summarized, the meteoric water mobility procedure consists of agitating the sample in distilled water and analyzing the rinsate for cyanide concentrations.

Splits of the 1991 samples were analyzed for WAD and total cyanide in the leached ore, and as a rinsate after completing the meteoric water mobility procedure. In 1991, the average WAD concentration in the leached ore was 2.02 mg/kg and ranged from 1.16 to 3.13 mg/kg. The total cyanide averaged 8.46 mg/kg and ranged from 7.39 to 10.41 mg/kg.

The meteoric water mobility rinsate averaged 1.11 mg/l and ranged from 0.05 to 2.91 mg/l total cyanide. Rinsate cyanide concentrations from the meteoric water mobility procedure were both considerably higher and lower than the cyanide levels in the corresponding leached ore splits, demonstrating the inherent uncertainty of cyanide analysis. The Utah Division of Water Quality considers the ore to be neutralized and has released BLM from any further neutralization requirements at the Timberline millsite.

Conclusions

Since reclamation and neutralization, no water has ponded on the site and no animal fatalities have occurred, thus achieving the goal of eliminating the immediate hazards at Timberline.

The average WAD cyanide concentration in 1990 was about twice the level measured during neutralization and is attributed to sampling methodology. During neutralization, surface samples were collected that were well mixed with neutralizing solution. The auger samples most likely contain material that was poorly mixed with the neutralizing solution.

In 1991 leached ore samples, the average cyanide concentration was 2.12 mg/kg WAD and 8.46 mg/kg. The average total cyanide concentration after performing the meteoric water mobility procedure was 1.11 mg/l.

Overall, there was a steady post-neutralization reduction in cyanide levels, and the leached ore has been neutralized to the point where the average total cyanide content meets the Utah Division of Water Quality standards. It should also be noted that the neutralization effort only met state standards due to the higher than normal allowances. It is doubtful that the current policy of neutralization to drinking water standards could have been met.

Discussion

If the current debate concerning the Surface Management Program results in mandatory bonding of operations using cyanide, the Bureau will need to calculate bond amounts. The Timberline heap leach was a very small operation, and the $20,000 bond appeared to be sufficient. However, reclamation could only be completed within budget by using lower-cost Bureau equipment, mining company volunteers, and generous cyanide standards from the Utah Division of Water Quality. It is recommended that bond amounts for cyanide operations undergo a thorough reclamation cost analysis based on contracting out all work and including costs for full neutralization.

Initial review of the notice or plan should include an assessment of the design parameters' ability to maintain the integrity of the systems. For example, 40-mil PVC degrades due to ultraviolet radiation and is quite susceptible to punctures, especially when placed on native soil. A sand layer under the pad liner that conducted fluids to a sump would provide effective leakage detection. Periodic inspections during heap leach construction could have alleviated some of the problems, such as no monitoring wells or sump connected to a leak detection system.

It is not suggested that the procedures used to complete reclamation of the Timberline heap leach are the only ones available, or even entirely appropriate. However, it is recommended that the Bureau be adaptable enough to use procedures, with due consideration for safety, that provide for cost-effective reclamation in a timely manner.

References

Buck, Brian, 1989, Personal Communication, Geologist and Principal, JBR Consultants Group, Salt Lake City, Utah.

McGrew, K.J., and Thrall, B.A., 1987, Heap Leach Processing at the Annie Creek Mine, unpublished report, Wharf Resources, Deadwood, South Dakota.

Appendix 1

JBR Site-Specific Health and Safety Plan

JBR SITE SPECIFIC HEALTH AND SAFETY PLAN

PROJECT NAME: Timberline Leach Pad

PROJECT NUMBER: BURLM-01

PROJECT MANAGER: BRIAN W.BUCK

CORPORATE SAFETY OFFICER: BRIAN W. BUCK
(Check if Designee ☐)

DECLARATION OF UNDERSTANDING

I have read and understand this Health and Safety Plan (HASP), and agree to abide by the procedures and limitations specified.

NOTE: 1) All personnel signing above must appear in Part G. Personnel categorization.
2) All sub-contractors to ESE must abide by the specifications and limitations contained in this HASP.

PROJECT SPECIFIC HEALTH AND SAFETY PLAN

A. GENERAL PROJECT INFORMATION

SITE: TIMBERLINE LEACH PAD DATE PREPARED: 10/09/89

LOCATION: West of Ophir Cyn.,Tooele County PREPARED BY: B.W.Buck

INVESTIGATIVE OBJECTIVE(S):
Project goal is todecommission an abandoned cyanide leach pad. The primary objective is to mitigate the potential for future release of cyanide by neutralize the contained cyanide.

PROPOSED DATE(S) OF INVESTIGATION: 10/16/89 through 10/20/89

PREFIELD BRIEFING DATE(S): 10/16/89 BACKGROUND REVIEW:
COMPLETE: [X]
PRELIMINARY: [ ]

PROJECT H.A.S.P. SUMMARY

LEVEL(S) OF PROTECTION: [ ] A [X] B [ ] C [X] D [ ] Mixed [X] Modified

OVERALL HAZARD ESTIMATE: [ ] High [ ] Moderate [X] Low [ ] Unknown

ADDITIONAL DOCUMENTATION: [X] TLV Table [ ] Full HASP [ ] Methods [ ] Other

B. SITE/MATERIAL CHARACTERISTICS

MATERIAL/WASTE TYPE(S): [ ] Liquid [X] Solid [X] Gas [X] Sludge IN [X] Drums [X] Tanks [X] Open

CHARACTERISTICS: [ ] Ignitable [X] Corrosive [X] Toxic [X] Reactive [ ] Radioactive
[ ] Volatile [ ] Unknown [ ] Other

FACILITY TYPE: Cyanide heap leach facility [ ] Closed [X] Open

FACILITY SIZE: Approximately 5 Acres

TOPOGRAPHY: Gently sloping to the west

PRINCIPAL DISPOSAL METHOD (type and location(s)):
Cyanide contaminated materials are present in the spent leach material on the leach pad; as sludge and liquid in the solution pond; and as residual reagent in the mixing tank.

UNUSUAL OR SIGNIFICANT FEATURES:
The liners of the pad and pond are in very poor shape with numerous holes and rips. Efforts should be made to prevent washing cyanide-containing solutions into these.

SITE HISTORY:
Facility was operated as a commercial mining operation until it was recently abandoned. During operations, sodium cyanide was mixed with water at high pH to produce a leaching solution. This was sprinkled on the ore heap and was collected in the pond for processing.

Additional site history information attached [ ]

C. HAZARD EVALUATION

INSTRUCTIONS: Evaluate principal hazards expected at this site; be specific and complete (Include chemical, physical, biological, etc.).

SODIUM CYANIDE was used as the leachate during operations and can be expected to be present in the spent leach material, solution pond,and mixing tank. It could also be present as spilled reagent around the site. This chemical is toxic (skin TLV 5mg/m^3)if contacted. It is also reactive and will produce hydrocyanic acid at pH levels less than 10 - 11. The sodium cyanide levels in the spent leach material have been determined to be from about 30mg/kg to less than 5mg/kg. These levels are not considered to be toxic for short-term contact. However, contact with skin and injestion should be avoided.

HYDROGEN CYANIDE (hydrocyanide acid) is liberated from sodium cyanide at pH levels of 10 - 11. Increasing amounts are liberated at lower pHs. This is a clear gas with an odor like almonds. It is toxic (skin TLV 5mg/m^3) if contacted with an IDLH level of 60mg/m^3. Inhalation of atmospheres containing 45-54 ppm may cause symptoms in 30-60 minutes; 110 ppm is fatal in one hour; and 270 ppm is rapidly fatal. All neutralization activities will be done at elevated pHs to minimize release of HCN. However, the low NaCN levels of the waste should also minimize the rate of HCN release.

SODIUM HYDROXIDE will be used as a reagent in the neutralizing solution. It should only be present on site in the shipping containers, and in low concentrations in the neutralizing solution. It is a corrosive chemical and is an irritant or burn agent to body tissues by all routes of exposure (TLV 2mg/m^3, IDLH 200mg/m^3). It will be purchased as a dry bead or flake solid and mixed with water in the application machine. All contact with the dry product or concentrated solutions should be avoided.

HYDROGEN PEROXIDE will be used as a reagent in the neutralizing solution. It will be present on site as a 35% solution in the shipping containers and will be mixed with water in the application machine to form a dilute solution of about 100 - 200 ppm. It is a colorless liquid that is fully soluble in water and has a sharp and irritating odor. It is an oxidizer which will irritate all body tissues upon contact or inhalation (TLV 1ppm, STEL 2ppm over 15 minutes). Contact with the reagent should be avoided.

COPPER SULFATE will be used as a reagent in the neutralizing solution. It will be present on site in a bag or cardboard container. It is a solid crystal or powder which is an irritant to all body tissues, particularly eyes and mucous membranes (TLV 1mg/m^3). ccntact with the pure reagent should be avoided and spills should be kept out of lake and streams because of its acute toxicity to aquatic species.

PHYSICAL hazards at this site are those which would normally be encountered at any construction or demolition site with the exception that the plastic liners are slippery when wet and can increase the chances of falls. Care should be taken when walking on the liners, particularly in the pond area.

TLV - Threshold Lethal Value
IDLH - Immediately Dangerous to Life or Health
STEL - Short Term Exposure Limit

D. WORK PLAN INSTRUCTIONS

WORK ZONES ESTABLISHED: [X] E.Z. [X] C.R.Z. [X] S.Z. [ ] Additional

ATTACH MAP/SKETCH; IDENTIFY: [X] Work Zones [ ] Structures [X] Contam. Areas [X] Perimeter [ ] Lev. of Protection [ ] Known Hazard

Location of: [X] First Aid Equipment [X] Safety Equipment [ ] Other (Explain)

NOTES:
Work within the exclusion zone (E.Z.) will be in level D clothing. The workers within this area will wear continuous cyanide monitors set to alarm at 10 ppm. If the cyanide levels exceed this amount, the workers in the E.Z. will wear supplied air respirators. Detector tubes will also be used during the day in the E.Z. and the contaminant reduction zone (C.R.Z.) to verify that the cyanide levels are within the TLV. Workers in the C.R.Z. will wear level D modified with splash gear and dust respirators when handling the dry neutralizing reagents and peroxide. The E.Z. is defined as the leach pad, solution pond, and solution mixing tank areas. The C.R.Z. will be the area within the existing fenceline, outside of the E.Z. All people entering the C.R.Z. will have read and signed this safety plan. The support zone (S.Z.) will be the area outside of the existing fenceline. There should not be a need for any special safety provisions in the S.Z. with the possible exception of restricting access to areas in the spray pattern of the hydroseeder.

PERSONAL PROTECTION REQUIRED: Level of Protection: [ ] A [ ] B [ ] C [X] D [ ] Mix [X] Mod

Mixed (Identify Areas/Levels):

Modifications (Identify action levels):
The level D protection of the E.Z. workers will be modified with continuous cyanide monitors. If high cyanide levels are detected, the E.Z. workers will wear supplied air respirators until the concentrations are less than 10 ppm. Workers in the C.R.Z. who handle the concentrated neutralizing chemicals will wear splash and respiratory protection.

ADDITIONAL PERSONAL PROTECTIVE EQUIPMENT (PPE):
Supplied air respirators will be available; (1) full-face with air line and large bottle for the dozer operator, and (1) SCBA for the site supervisor. cyanide monitors will be set to alarm and will be worn by E.Z. workers. C.R.Z. workers will wear full face air-purifying respirators when handling chemicals.

SURVEILLANCE EQUIPMENT: [ ] PID [ ] FID [X] Toxic Gas [X] Detector Tubes [ ] Radiation [ ] Oxygen [ ] Explosimeter [ ] Personal Monitor [ ] Other

EQUIPMENT NOTES (Include calibration, decon, etc.):
Detector tubes will be used in the E.Z. and C.R.Z. as deemed necessary by the site supervisor.

E. SITE OPERATIONS/DECONTAMINATION

HOTLINE LOCATION (Initial):
The hotline location will be the boundary of the leach pad and solution pond.

COMMAND POST LOCATION (Initial):
The command post will be the location of the site supervisor's vehicle.

PERSONAL DECONTAMINATION STATIONS:

1. Reagent mixing area
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

EQUIPMENT AND MATERIALS/SPECIAL FACILITIES:
NEUTRALIZING SOLUTION/ 100 - 200ppm H_2O_2 + 5ppm Cu^{2+} at pH 10+
APPLICATOR MACHINE/ hydroseeder provided by Barrick Resources
Level B Breathing Apparatus/Air tank and air line on CAT,+ (1) SCBA
DETECTOR TUBES/ Sensidyne provided by JBR and Barrick
EARTH MOVING EQUIPMENT/ bulldozer provided by the BLM
Personal Protective Clothing/ provided by JBR and Barrick

EQUIPMENT DECONTAMINATION/DISPOSAL:
Major equipment decontamination will occur on the C.R.Z. using the neutralizing solution. All solid waste thought to contain any cyanide will be cleaned with the neutralizing solution and disposed as solid waste. **See Quality Assurance Plan** ☐

SITE ENTRY PROCEDURES: All entry through the east gate.

Team Size: 4-5 minimum **Pre-field Briefing Date:** 10/16/89

Work Schedule:
Normal day shift hours (7-8 AM to 4-5PM)

Limitations:
Work should not proceed in rain or shortly following rain because the spent leach material will be too wet to accept enough neutralizing solution and still be workable.

Notes:

F. EMERGENCY PRECAUTIONS

EMERGENCY ACTIONS:

FIRE:
Some chance that reagent containers may rupture in a fire. Use dry fire extinguishers and avoid caustic spatter or splash if using water.

EXPLOSION:
Prevent contact of caustic with metals where hydrogen gas may be confined and ignited by spark or flame.

WEATHER:
Curtail operations in wet weather. Prevent wetting the caustic.

INJURY:
Respirators restrict vision; give way as necessary. Avoid being splashed with reagents or neutralizing solution. Liners are slippery.

OTHER:
Wash reagent splashes with plenty of fresh water get medical attention. Give fresh air and amyl nitrate (if needed) for HCN inhalation.

CHEMICAL EXPOSURE ACTIONS:

Material	Symptoms	Treatment	TLV (ppm)
Sodium Cyanide	irritation,wknss,head,naus	fresh air, wash skin	5mg/m^3
Hydrogen Cyanide	same	fresh air, amyl nitrate	"
Sodium Hydroxide	irritation, burns	fresh air, wash skin	2mg/m^3
Hydrogen Peroxide	irritation of eyes, nose, skin	"	1ppm
Copper sulfate	"	"	1mg/m^3

POLICE: 882-5600 **CHEMTREC:** (800) 424-9300 **OTHER:**

HOSPITALS/INFIRMARIES (2):

PRIMARY HOSPITAL/INFIRMARY

Telephone: 882-1697

Address: Tooele Valley Regional Medical Center

Directions: 211S. 100E Tooele, Utah

ALTERNATE HOSPITAL/INFIRMARY

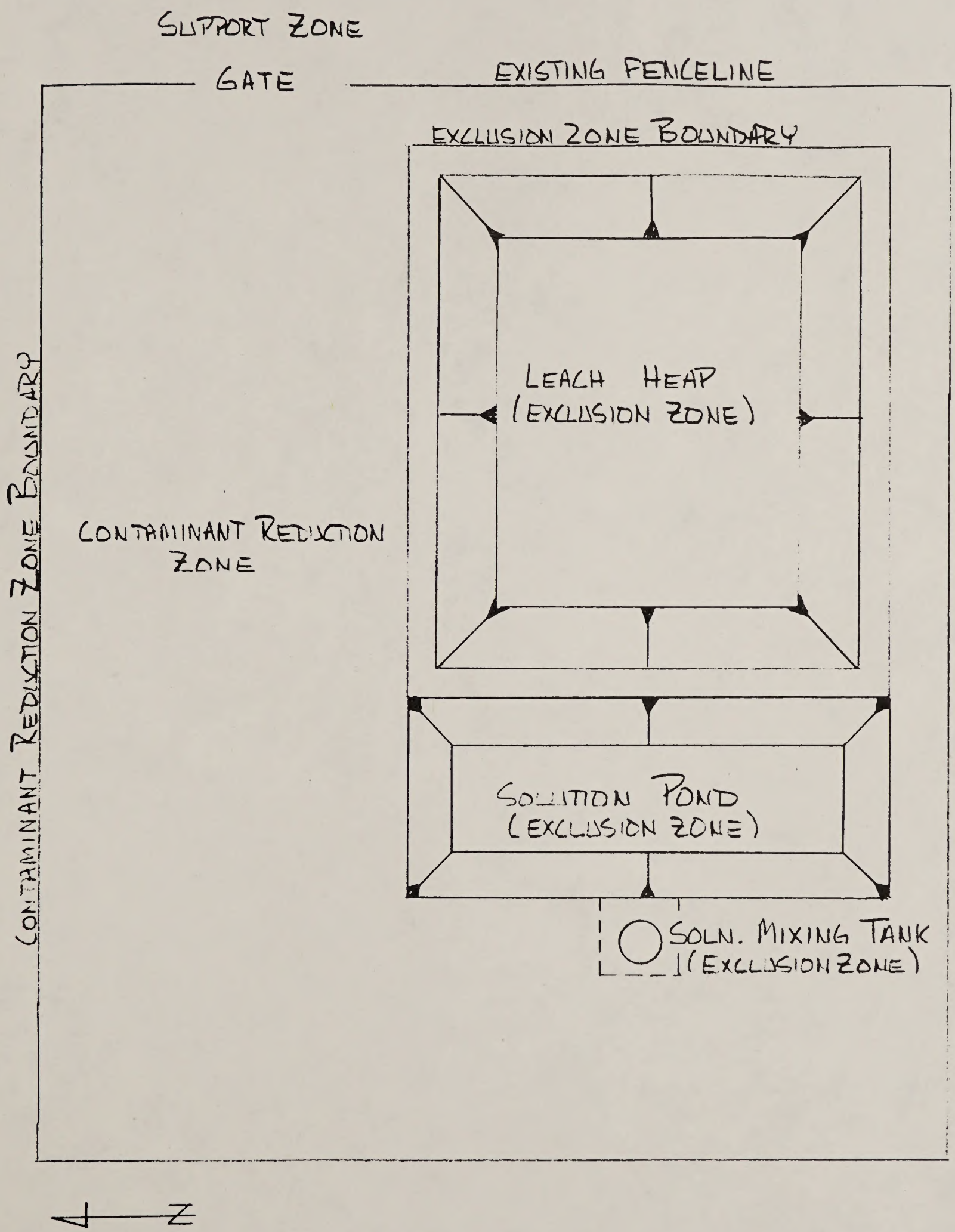
Telephone: County Sheriff 882-5600

Address: Air-Med or Life Flight in Salt Lake City

Directions:

TIMBERLINE LEACH PAD SITE MAP

Schematic - Not To Scale



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